

Introduction and Overview

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A Renewable electricity, local production and long-distance trade

Modern societies rely extensively on the supply and consumption of electricity. A multitude of daily life and work activities depend on electricity-powered technology, machinery and infrastructure, the use of which either has transformed or is still transforming the residential, commercial, industrial and transportation sectors.¹ The use of electricity drives economic growth, facilitates international commerce and enhances the welfare of people around the world. Accordingly, global electricity consumption has steadily increased,² driven by the ever faster pace of technological innovation and a number of structural factors that include demographic trends, the exceptional growth performances of developing Asian and other emerging economies in recent decades and the rapid electrification of countries that are currently at earlier stages of development.³ At the same time, approximately two-thirds of the world's electricity is today generated through fossil fuel combustion, and half of this is still produced in coal-fired power plants. Electricity is the principal source of energy-related greenhouse gas (GHG) emissions,⁴ which in turn account for two-thirds of

¹ Euroelectric, *A Sector in Transformation: Electricity Industry Trends and Figures* (2015), www.euroelectric.org/media/161808/electricityindustrytrendsandfigures2015_lr-2015-030-0064-01-e.pdf (accessed 8 February 2016).

² International Energy Agency (IEA), *World Energy Outlook Special Report: Trade and Climate Change* (2015), www.iea.org/publications/freepublications/publication/WEO2015SpecialReportonEnergyandClimateChange.pdf (accessed 15 December 2015), p. 27.

³ IEA, *World Energy Outlook Report* (2015), www.worldenergyoutlook.org/media/weo-website/2015/WEO2015_Chapter01.pdf (accessed 8 February 2016), pp. 37–40; IEA, *World Energy Outlook Electricity Database* (2015), www.worldenergyoutlook.org/resources/energydevelopment/energyaccessdatabase/ (accessed 8 February 2016).

⁴ IEA, *World Energy Outlook Report*, pp. 300–19.

global GHG emissions.⁵ The decarbonisation of the electricity sector has accordingly figured prominently on national and supra-national climate change agendas.⁶ Efforts have converged towards the promotion of electricity produced from renewable energy (RE) sources and towards allowing for differential treatment of fossil and RE electricity within the multilateral trading system.⁷ The shift to renewables in power generation carries the greatest potential for GHG emissions abatement in the energy sector as a whole.⁸

Climate change and international trade was the subject of a previous World Trade Forum.⁹ The present volume turns to international trade in electricity, more specifically addressing the challenges posed by the transition towards renewably produced electricity and the role of international trade in this process, supporting growth as well as decarbonisation and climate change mitigation. Until very recently, electricity itself had been traded rather limitedly compared to the large volumes of primary energy supplies, namely oil and gas, being imported into many countries for electricity production. Electricity generation has mainly occurred locally, regionally and nationally, with international trade essentially limited to trade in surplus production between neighbouring countries. Technical and political constraints hampered long-distance, inter-regional and transcontinental trade in electricity supplies. This has been changing in recent years due to advances in technology, and for a number of other reasons.

⁵ IEA, *World Energy Outlook Special Report 2013: Redrawing the Energy-Climate Map* (2013), www.worldenergyoutlook.org/media/weowebsite/2013/energyclimatemap/RedrawingEnergyClimateMap.pdf (accessed 8 February 2016), p. 15.

⁶ See, e.g., EurElectric, *Power Statistics and Trends* (2015), www.eurelectric.org/media/249736/power-statistics-and-trends-the-five-dimensions-of-the-energy-union-lr-2015-030-0641-01-e.pdf (accessed 8 February 2016); European Commission, *A Policy Framework for Climate and Energy in the Period from 2020 to 2030* (2014), <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0015&from=EN> (accessed 8 February 2016), p. 5; The White House, *President Obama's Climate Action Plan* (2015), www.whitehouse.gov/sites/default/files/docs/cap_progress_report_final_w_cover.pdf (accessed 8 February 2016), p. 6.

⁷ See T. Cottier, *Renewable Energy and Process and Production Methods*, E15 Initiative (Geneva: International Centre for Trade and Sustainable Development (ICTSD) and World Economic Forum, 2015), <http://e15initiative.org/publications/renewable-energy-and-process-and-production-methods/> (accessed 8 February 2016).

⁸ IEA, *World Energy Outlook Report*, pp. 300–3.

⁹ T. Cottier, O. Nartova and S. Z. Bigdeli (eds.), *International Trade Regulation and the Mitigation of Climate Change: World Trade Forum* (Cambridge: Cambridge University Press, 2009).

First, local production of renewable electricity based upon hydro, solar, wind, thermal and tidal power offers an important contribution to supplies, but is unable on its own to provide the necessary stable baseload without recourse to oil, gas and coal or nuclear energy. Fluctuations caused by climatic conditions are too strong. The integration of increasing shares of RE electricity is therefore dependent upon the reinforcement of transmission interconnectors and the extension of grids over larger regions.¹⁰ Second, the tremendous progress in electricity transmission technologies achieved in recent times has made long-distance electricity flows possible both technically and economically, facilitating cross-border electricity interconnections.¹¹ Modern high-voltage, direct current (HVDC) transmission lines, both on land and sea, offer the technology for long-distance transmission without substantial voltage losses. Long-distance transmission lines are able to reduce the requirement for balancing power, especially for fluctuating carbon-neutral sources such as wind and solar energy, from fully dispatchable conventional generators. They therefore contribute to increasing the reliability of supply while avoiding GHG emissions.¹²

The benefits associated with large-scale electricity transmission projects include the expansion of electricity trade areas, the promotion of competition in electricity generation (and thus the reduction of electricity prices) and the enhancement of reliability and security of supply.¹³ Extending the grid over larger regions can facilitate the exploitation of comparative advantages in electricity production while carrying the potential to create stable supplies to countries located in those parts of the world that suffer from chronic shortages, by means of international trade. Furthermore, it can help to harvest RE from remote

¹⁰ J. Sauvage and H. Bahar, 'Cross-border trade in electricity and the development of renewables-based electric power', *OECD Trade and Environment Working Papers* 2013/02 (2013), www.oecd-ilibrary.org/trade/cross-border-trade-in-electricity-and-the-development-of-renewables-based-electric-power_5k4869cdwnzr-en (accessed 8 February 2016).

¹¹ Massachusetts Institute of Technology Energy Initiative, *The Future of the Electric Grid: An Interdisciplinary MIT Study* (Cambridge, MA: Massachusetts Institute of Technology, 2011); T. Gönen, *Electrical Power Transmission System Engineering: Analysis and Design*, 3rd edn (Boca Raton, FL: CRC Press, 2014).

¹² S. Chatzivasileiadis, D. Ernst and G. Andersson, 'The Global Grid', *Renewable Energy*, 57 (2013), 372.

¹³ International Energy Agency, *Secure and Efficient Electricity Supply during the Transition to Low Carbon Power Systems* (Paris: IEA, 2013), www.iea.org/publications/freepublications/publication/secureandefficientelectricitysupply.pdf (accessed 8 February 2016).

locations with abundant potential and very low production costs.¹⁴ Accordingly, it could generate new sources of income, for example, from electricity produced from wind energy in the North and solar energy in the South, in regions that have faced difficulties in creating adequate economic growth.

Trends confirm these insights. The increasing global demand for electricity and the need for renewable production reflect the development and expansion of electricity networks and the intensification of cross-border electricity trade.¹⁵ Because electricity trade relies on fixed physical infrastructure, the former is dependent on the latter, as is the case for all other network-bound industries (e.g. telecommunications and railways).¹⁶ The progressive integration of electricity grids at the national level has paved the way for the creation of the first regional electricity systems, with some prominent examples including the European Union (EU) internal electricity market,¹⁷ the Integrated Power System (IPS),¹⁸

¹⁴ In recent years, various projects have undergone first feasibility assessments and have been launched in Europe, Asia and the Atlantic. For instance, projects such as Medgrid and OffshoreGrid will interconnect Mediterranean states with Europe, permitting the transfer of high shares of solar energy to the major load centres. Initiatives such as Gobitec in Asia and the Atlantic Wind Connection in the United States will interconnect the Asian power grids or transmit offshore wind energy to the US east coast. See Chapter 2.

¹⁵ Energy Charter Treaty Secretariat, *Model Intergovernmental and Host Government Agreements for Cross-Border Electricity Projects*, www.energycharter.org/fileadmin/DocumentsMedia/Legal/EMAs_en.pdf (accessed 8 February 2016).

¹⁶ P. J. Slot and A. Skudder, 'Common features of community law regulation in the network-bound sectors', *Common Market Law Review*, 38 (2001), 87.

¹⁷ See P. Mäntysaari, *EU Electricity Trade Law: The Legal Tools of Electricity Producers in the Internal Electricity Market* (Heidelberg: Springer International Publishing, 2015); Directive 2009/72/EC of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:211:0055:0093:EN:PDF> (accessed 8 February 2016); and Regulation (EC) 714/2009 of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003, <http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32009R0714> (accessed 8 February 2016).

¹⁸ The Integrated Power System is an integrated transmission network based on the former Soviet Union electricity system. It currently connects the national grids of Latvia, Lithuania, Estonia, Armenia, Azerbaijan, Belarus, Georgia, Kyrgyzstan, Moldova, Tajikistan, Uzbekistan, Ukraine and Mongolia, while supplying electricity to Finland and some regions of China. See I. Tchakalov, T. Mitev and I. Hristov, 'Bulgarian power relations: the making of a Balkan power hub' in P. Högselius, A. Hommels, A. Kaijser and E. van der Vleuten (eds.), *The Making of Europe's Critical Infrastructure: Common Connections and Shared Vulnerabilities* (Basingstoke: Palgrave Macmillan, 2013), pp. 138–40.

the Southern African Power Pool (SAPP)¹⁹ and the Central American Power System (SIEPAC).²⁰ Much, of course, remains to be done, and many countries in the developing world continue to suffer from insufficiently connected grids.

B Towards a Global Grid

Based on current and projected power trends and the estimated impact of technological innovations on electricity networks, experts envisage that the gradual implementation of cross-border electricity transmission projects on a large scale and over long distances will lead to the creation of regional supergrids and, eventually, a globally interconnected network.²¹ The idea of a so-called global grid, of course, reflects a long-term vision which, if it materialises at all, will do so over a long period of time. It builds upon the philosophy and reality of an increasingly interconnected world, starting with the telegraph and moving through the telephone and now on to the Internet. Although technically feasible, it will require large volumes of investment in highly capital-intensive infrastructure projects, availability of fixed infrastructure and non-discriminatory access to transportation networks and distribution systems, along with mechanisms for transparent and efficient cross-border trading to facilitate the power exchange between regions. We perceive the idea of a global grid as

¹⁹ The Southern African Power Pool is the largest and most advanced power pool in Africa and covers the networks of Democratic Republic of Congo, Tanzania, Angola, Zambia, Malawi, Namibia, Botswana, Zimbabwe, Mozambique, Swaziland, South Africa and Lesotho. See Infrastructure Consortium for Africa, *Regional Power Status in African Power Pools*, African Development Bank (2011), www.icafrica.org/fileadmin/documents/Knowledge/Energy/ICA_RegionalPowerPools_Report.pdf (accessed 8 February 2016).

²⁰ The Central American Electrical Interconnection System is the largest power system in Latin America and comprises the national electricity grids of Panama, Costa Rica, Honduras, Nicaragua, El Salvador and Guatemala: Proyeto Mesoamerica, *Costa Rica completa línea de transmisión eléctrica SIEPAC*, San José, Costa Rica (16 October 2014), www.proyctomesoamerica.org/joomla/index.php?option=com_content&view=article&id=731&Itemid=85 (accessed 8 February 2016) and Economic Consulting Associates, *The Potential of Regional Power Sector Integration: Central American Electric Interconnection System (SIEPAC) Transmission & Trading Case Study* (2010), www.esmap.org/sites/esmap.org/files/BN004-10_REISP-CD_Central%20American%20Electric%20Interconnection%20System-Transmisison%20&%20Trading.pdf (accessed 8 February 2016).

²¹ See, in particular, Chatzivasileiadis, Ernst and Andersson, 'The Global Grid'; C. Barker, 'Practical management of variable and distributed resources in power grids' in L. E. Jones (ed.), *Renewable Energy Integration: Practical Management of Variability* (Amsterdam: Elsevier Academic Publishing, 2013), pp. 189–202.

a long-term perspective, an agenda for change. A global grid may eventually be, and should be, built upon existing national and inter-regional grid structures. As this will necessitate interfacing different systems, the legal framework, both domestically and internationally, should respond to this challenge by fostering and allowing the development of the necessary structures of multilevel governance. While it is often felt that progress in RE electricity is a matter of creating domestic policy space, it is more a question of properly allocating regulatory powers at the different levels of governance in order to produce the public good of safe and abundant supplies.²²

In this perspective, this volume aims at identifying and discussing the regulatory challenges that the changing landscape of electricity trade (from neighbouring through contiguous to distant states) poses to the international trade and investment regimes as a way of preparing the tools for inter-regional interfaces in the future. Because international trade and investment rules were not drafted with electricity in mind,²³ the main overarching question, which is woven through the analyses in this book, is whether the trade and investment legal frameworks are sufficiently well equipped to enable, facilitate and possibly encourage long-distance electricity trade and, in particular, trade in electricity produced from RE sources.

In attempting to answer this question, this volume breaks new ground in several respects. First, the role of international trade and investment law in the field of electricity, as already indicated, has until recently been a limited one: for a long time, electricity – and the energy sector in general – has been regulated through a sovereignty-based approach, classically falling within the scope of national jurisdictions.²⁴ Second, despite the gradual expansion of cross-border electricity trade, the still predominant regional dimension has so far delayed the discourse on the extent to which international trade and investment rules can facilitate the

²² T. Cottier, 'Renewable energy and WTO law: more policy space or enhanced disciplines?' *Renewable Energy Law and Policy Review*, 1 (2014), 40–52.

²³ T. Cottier, G. Malumfashi, S. Matteotti-Berkutova, O. Nartova, J. de Sèpibus and S. Z. Bigdeli, 'Energy law and policy' in T. Cottier and P. Delimatsis (eds.), *The Prospects of International Trade Regulation: From Fragmentation to Coherence* (Cambridge: Cambridge University Press, 2011), pp. 214–5.

²⁴ J. Pauwelyn, 'Global challenges at the intersection of trade, energy and the environment: an introduction' in J. Pauwelyn (ed.), *Global Challenges at the Intersection of Trade, Energy and the Environment* (Geneva: Centre for Trade and Economic Integration, 2009), p. 3.

reinforcement of transmission interconnections and increase their security and stability along with the share of renewables fed into the grid.²⁵ Moreover, the focus on the EU international electricity market has left other regional experiences in the shade and contributed to putting EU law centre-stage in the debate on cross-border electricity trade.²⁶ Discussions in the international trade and investment domains have focused on the question of the policy space left to national governments with regard to introducing and/or terminating RE public support schemes, as well as trade remedies aimed at levelling the playing field in response to such measures.²⁷ Yet, the expansion of international trade in electricity and, in particular, RE electricity inevitably raises electricity-specific issues related to the physical peculiarities of electricity transmission and trade.²⁸

C The Goals and Structure of This Study

Against this backdrop, the purpose of this volume is to explore the implications of the most recent technical, geopolitical and economic developments affecting international trade in electricity for the multilateral legal framework on trade and investment. The book will also provide suggestions on how to improve the existing framework in a way that ensures there is coherence throughout the various levels of governance which are going to be affected by the expansion of the electricity grid over

²⁵ In recent years, discussions on the importance of a multilateral legal framework for trade in energy have gradually gained prominence. See, e.g., Y. Selivanova (ed.), *Regulation of Energy in International Trade Law* (Alphen aan den Rijn: Kluwer Law International, 2011). Yet, none have focused on electricity-specific issues.

²⁶ So far, the most comprehensive analyses of the electricity sector, including regulatory aspects of trade and investment, have focused on the European experience. See, e.g., M. Roggenkamp, C. Redgwell, A. Rønne and I. del Guayo (eds.), *Energy Law in Europe: National, EU and International Regulation* (Oxford: Oxford University Press, 2007), and J. Bielecki and M. G. Desta (eds.), *Electricity Trade in Europe: Review of the Economic and Regulatory Challenges* (Alphen aan den Rijn: Kluwer Law International, 2004).

²⁷ Many challenges have recently been filed against RE public support programmes before the WTO Dispute Settlement Body and many claims have been initiated by investors under international investment treaties. For an overview see, among others, J. Salzman and M. Wu, 'The next generation of trade and environment conflicts: the rise of green energy policy', *Northwestern University Law Review*, 108 (2014), 401; K. Talus (ed.), 'Special issue on renewable energy disputes', *Oil, Gas & Energy Law*, 3 (2015).

²⁸ Once generated from energy sources, electricity has to be transmitted through high-voltage networks to major demand centres and distributed to the final consumers. Electricity trading is thus dependent on the interconnectivity of physical infrastructure and the availability of transmission capacity. W. Patterson, *Transforming Electricity* (London: Earthscan, 1999).

larger regions. To achieve its objectives, the book is divided into four parts, which, taken together, can provide the reader with a comprehensive understanding of the issues at stake in the field of electricity and the lessons that can be drawn from an analysis of the state of play in the current international trade and investment regimes. The four parts correspond to the following four thematic areas:

- (i) the technical and economic foundations of a global grid;
- (ii) regional experiences with cross-border electricity trade;
- (iii) the specific interconnectivity issues posed by electricity transportation and their implications for international trade and investment law in working towards inter-regional trade in electricity;
- (iv) the regulatory challenges raised in the trade and investment fields by the quest for a level playing field in the promotion of RE electricity.

Part I of the volume takes stock of the technical advances that have been made in electrical engineering and cross-border electricity trade, and identifies the current challenges posed by the expansion of inter-regional electricity grids. It also examines the economic and geopolitical determinants of international trade in electricity and addresses electricity governance issues. Chatzivasileiadis and Ernst build on the analysis of recent technical improvements in electricity network development to conceptualise the idea of a global grid as a means to efficiently integrate renewables into the grid while ensuring reliability and security of supply. They show that long-distance interconnections can be both technically feasible and economically competitive, in addition to being environmentally desirable. They identify the main market operation and regulatory challenges posed by cross-border electricity trade and underscore the need for further research to find appropriate solutions to market-coupling obstacles when interconnecting larger regions in the longer term. In the same vein, Houmøller elaborates on the possible practical solutions to the political problems raised by market coupling over vast areas, focusing on the role and tasks to be attributed to regulators. He draws on the European example to argue that a single spot exchange can ensure a reliable and cost-efficient day-ahead congestion management system, again in the spirit of facilitating the shift to renewables in the electricity sector. Robinson complements the technical stock-taking of cross-border electricity trade with an analysis of the economic and geopolitical drivers of trade in electricity. He points out that, irrespective of technical feasibility, sound economics, political stability and shared values are necessary preconditions to overcome the costs and

limits of building interconnectors and trading electricity, especially when generated from RE sources. He argues that any reform process aimed at fostering RE electricity trade must be based on political stability and a shared long-term vision for the peoples of the different countries involved. Defilla maps the global intergovernmental and non-governmental organisations that play a role in the electricity industry. Based on an analysis of the most pressing regulatory challenges posed by the technological improvements occurring in the sector, he examines various options for good governance for the future global electricity grid. He contends that the Energy Charter Treaty (ECT), as a unique multi-lateral and legally binding framework dealing exclusively with energy issues, could play a key role in this respect, provided that renewables receive sufficient priority and that a specific instrument (a treaty or a protocol) for electricity can be developed.

Part II provides an in-depth analysis of the experiences of the most important regions of the world in promoting electricity trade integration, and RE electricity in particular. Le Page starts by describing the EU experience. He recollects the fundamental steps in the creation of the internal energy market, from the early 1990s to the adoption of the Third Energy Package in 2009. He gives an account of the set of policies pursued in parallel by the EU and its Member States to set out the path towards decarbonisation, with a particular focus on the power generation industry. In his opinion, greater coherence between the EU energy and climate frameworks is the only way to limit distortions to the internal energy market to a minimum while still ensuring a level playing field for investment in RE production and the achievement of RE targets in a cost-efficient manner. Sioshansi discusses the North American experience (United States and Canada). He notes that, to date, green electricity generation and trade has mainly been encouraged at the level of individual states, provinces, cities and communities (as well as a growing number of corporations), rather than at the federal level. Accordingly, he suggests that policy-makers focused on encouraging RE electricity trade must remain cognisant of such bottom-up developments in the region and revisit their approaches with a consideration of the challenges posed by decentralised RE electricity produced by so-called 'prosumers'. Jusoh describes the Asian experience, focusing on the Member States of the Association of Southeast Asian Nations (ASEAN). After giving an account of the state of play in RE electricity trade in ASEAN Member States, he underscores the many challenges they face in ensuring that green electricity trade in the region meets the objectives of the ASEAN

Community 2015, from rural electrification to technology development and innovation in the field, from raw material supply to trade facilitation. He urges ASEAN Member States to make a concerted effort to stimulate a new policy approach for the promotion of RE electricity which tackles issues incidental to energy transformation, such as sustainable development. Kambanda focuses on the African experience. He notes that, with the exception of the SAPP, African power pools are still in their developmental stages, and electricity trade is mostly based on bilateral agreements. He contends that regional electricity trade in Africa remains limited because of a lack of physical infrastructure (due in part to lack of access to capital), poor planning, lack of maintenance and poor performance of the power utilities. Based on the continent's huge hydro, solar and geothermal potential, however, he suggests that African countries should establish RE targets, combined with additional incentives for attracting RE investments, in order to overcome these challenges. Lembo and Eleoterio conclude Part II by describing the Latin American experience. They observe that current electricity cooperation and integration projects in the Americas are focused on the development of regional grid interconnections that are supported by bilateral and regional agreements. While acknowledging the efforts of Latin American countries to foster RE electricity trade, they argue that the lack of a common regulatory framework remains a major obstacle to all electricity integration projects in the region. Accordingly, they advocate for new rules to provide coherence to cross-border electricity trade in Latin America.

Part III looks at the main interconnectivity issues raised by the peculiarities of electricity transportation and trade via fixed grids, and their implications for the trade and investment legal framework. Selivanova explores relevant international trade rules disciplining the conditions for access to fixed electricity infrastructure, namely the rules on transit in Article V of the General Agreement on Tariffs and Trade (GATT) and the General Agreement on Trade in Services (GATS) disciplines related to energy services. She finds that Article V does not address, among others, the issue of construction of new transit capacity – for which, she contends, an effective investment framework is needed. She notes that GATS rules do not currently address the anti-competitive practices that are common among incumbents controlling different segments upstream and downstream along the energy value chain. She proposes that additional commitments be negotiated either in an annex to GATS on Energy Services or in a Reference Paper to address competition issues and problems of third-party access to fixed infrastructure. Gudas moves

to issues of connection, access and dispatch of electricity to the electricity network, and focuses on the particular question of whether renewables should be given special treatment at the grid operation level. He argues that, instead of priority rules, the regulation of connection to the grid and the operation of the grid should be subject to rules aimed at ensuring neutrality across technologies through grid adaptation and market arrangements. Espa follows with an analysis of the international trade rules on import and export restrictions, which are relevant to addressing the range of practices affecting cross-border electricity (and, in particular, RE electricity) flows. She finds that generic WTO rules are not designed in a way that can accommodate the peculiar needs of (RE) electricity trade, namely cross-border balancing and congestion management. She suggests possible directions to overcome these drawbacks based on a comparative analysis of pertinent electricity-specific rules developed at the regional level incorporating RE promotion goals (i.e. EU secondary law). De Sépibus explores the regulatory challenges posed by the ongoing paradigm shift in electricity regulation, from grid operators to the advent of 'smart grids', focusing on the EU experience. She argues that the current focus on grid tariffs has to give way to a broader view, which encompasses all terms and conditions related to access to the facilities that are essential for smart grid activities. She further contends that the role of the regulator should be revisited so as to reflect the increasing involvement of third parties in the grid business and should be limited to tackling market failures and ensuring the pursuit of public policy goals. Kunze addresses the specific interoperability challenges faced by transmission system operators (TSOs) resulting from the development of decentralised capacity mechanisms and the implementation of 'disruptive' technologies. Building on a case study of Switzerland, he argues that these structural changes call on TSOs to introduce market design structures that allow for the optimisation of flexibility potentials coming from the integration of renewables into the grid. He suggests that such structures have to be defined taking into account political and organisational factors such as the role of the balancing responsible parties and the mechanisms to increase the price signal within a short timeframe at a very early stage of the planning.

Part IV of the book deals with the regulatory challenges arising out of the proliferation of transitional policy instruments aimed at supporting clean energy industries and electricity produced from renewable sources. Rubini addresses the question of the policy space for subsidies in support of RE energy and electricity, in particular under the WTO Agreement on

Subsidies and Countervailing Measures (ASCM). He introduces the concepts of 'point of balance' and 'trade-offs' to challenge ASCM disciplines as they currently stand. Reaching the conclusion that such disciplines, as interpreted by recent case law, are not only unclear and unsound, but also inadequate in the light of the economic, political and legal circumstances of today's world, he stresses the need to create the necessary conditions for starting a process of reform, namely by advancing knowledge and understanding of the current drawbacks, based on consistent and reliable data. Vermulst and Meng examine the most pressing dumping and countervailing duties (CVD) issues that have emerged in the new era of RE-targeted trade disputes, with a focus on the trade defence cases against solar products from China and the issues in the biofuels/biodiesel disputes involving the EU, Argentina and Indonesia at both the EU and the WTO levels. They argue that the proliferation of such disputes has increased the attention paid to certain disputable methodologies applied by some user countries such as the United States and the EU. They posit that such scrutiny will make interested parties better informed as to how subsidies and other support measures are likely to be treated in trade disputes domestically and at the WTO. Holzer, Espa and Payosova explore the legal feasibility of a system of differential taxation on electricity based on its energy sources or its carbon footprint. They argue that imposing higher rates of taxes on electricity produced from fossil fuel and applying lower tax rates or granting exemptions to green electricity can create appropriate incentives for RE production without burdening public resources. They contend that there are options for designing such a scheme in a way that would be compatible with relevant WTO rules under the GATT and the ASCM.

The final three chapters of Part IV explore competition and investment issues related to the promotion of RE electricity, including the role of monopolies, technological transfer and the treatment of regulatory takings. Nartova examines general trends in the effects of competition policy, institutional monopolies and the role of governments in promoting RE electricity. She posits that government incentives and environmental laws are needed to ensure effective development of RE electricity. She goes on to suggest that states should enact appropriate horizontal agreements and practices in their environmental and competition policy and evaluate the environmental impacts of their internal restrictive practices and how they affect competition in the energy sector. Abbott identifies the aspects of technology transfer that may be relevant to long-distance trade in RE electricity and explores whether there are

potential obstacles to such trade coming from intellectual property law. He suggests that transfers of technology directed towards establishing a globally interconnected electricity network should begin at a more modest level through bilateral and regional electricity-sharing agreements and programmes. Finally, Matteotti and Payosova examine the tensions emerging in interventional investment law when it comes to finding a reasonable balance between the interests of an investor and a state's legitimate right to regulate the RE sector on its own territory. After considering the most recent RE-related arbitration awards under various investment agreements, they conclude that the current international investment law framework does not seem to offer significant legal security either for investors or for host states. They provide a number of policy recommendations that governments may use when implementing new RE support schemes or amending the existing ones in the RE sector, and which are based on recent interpretations of the fair and equitable treatment standard in investment jurisprudence.

D Conclusions

The contributions to this volume offer interesting and relevant building blocks for use in the quest for law governing international trade and investment in (RE) electricity. They are not exhaustive, and other important areas, such as the implications of the law of the sea for marine electrical cables,²⁹ are not addressed in this volume, as its scope is limited to trade and investment. Nor have we dealt extensively with the pressing issue of subsidies allocated to fossil fuels and how they inherently influence the regulation of RE sources.³⁰ A key message of the book is that there is a need for much more constructive dialogue

²⁹ See D. R. Burnett, R. Beckman and T. M. Davenport (eds.), *Submarine Cables: The Handbook of Law and Policy* (Leiden: Martinus Nijhoff, 2014); T. Davenport, 'The installation of submarine power cables under UNCLOS: legal and policy issues', *German Yearbook of International Law*, 56 (2013), 107; K. Meissner, H. Schabelon, J. Bellebaum and H. Sordyl, *Impacts of Submarine Cables on the Marine Environment* (2007), www.bfn.de/fileadmin/BfN/meeresundkuestenschutz/Dokumente/BfN_Literaturstudie_Effekte_marine_Kabel_2007-02_01.pdf (accessed 15 December 2015).

³⁰ I. Espa and S. E. Rolland, *Subsidies, Clean Energy and Climate Change*, E15 Initiative (Geneva: International Centre for Trade and Sustainable Development (ICTSD) and World Economic Forum, 2015), <http://e15initiative.org/publications/subsidies-clean-energy-and-climate-change/> (accessed 10 March 2016).

among lawyers, economists, political scientists and engineers studying the challenges posed by cross-border electricity trade. Accordingly, this volume aims at stimulating cross-fertilisation across these disciplines by showing how researchers from different fields tackle the same substantive questions and share a common vision for the future of electricity trade.

All contributors agree, in particular, that the unprecedented challenge of global warming requires the decarbonisation of the electricity sector, to be achieved through a rapid and substantial shift to renewables. They also agree that the efficient integration of increasing shares of RE sources and the need to satisfy increasing demand for electricity in many parts of the world will lead to the gradual integration of national, regional and, eventually, inter-regional grids, in parallel with the development of mechanisms designed to cope with decentralised energy production. Finally, they agree that the reinforcement of transmission interconnectors and the extension of grids over larger regions poses a number of regulatory challenges to the trade and investment framework. Market integration prospects depend heavily upon appropriate structures of international governance. Objections raised with respect to the vision of a global grid have thus focused on security and dependency issues, suggesting that such vision will take a long time to evolve in a piecemeal manner. While the proposals formulated and the answers provided differ, all contributors agree that the focus in this phase should be on how to design the process for reform and frame it in the right way. The accent is put on the need to generate knowledge and meaningful discussion among all the different stakeholders on the peculiarities of electricity and, in particular, RE electricity trade and investment as the necessary precondition for possible future negotiations.

In this respect, for all the reasons already mentioned, the aim of this volume is to make a useful contribution to the advancement of knowledge and understanding of the problems raised by the changing landscape of electricity trade, and the challenges this poses to the trade and investment framework. We hope that the volume may help in assessing the way forward within the multilateral trading system and within the emerging regional trade agreements. This will be achieved through identifying relevant building blocks that could inform either the advent of sectorial agreements on trade and investment in electricity or the reform of existing provisions and agreements to render them conducive to achieving the goal of stable and decarbonised supplies of electricity to all humankind.

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